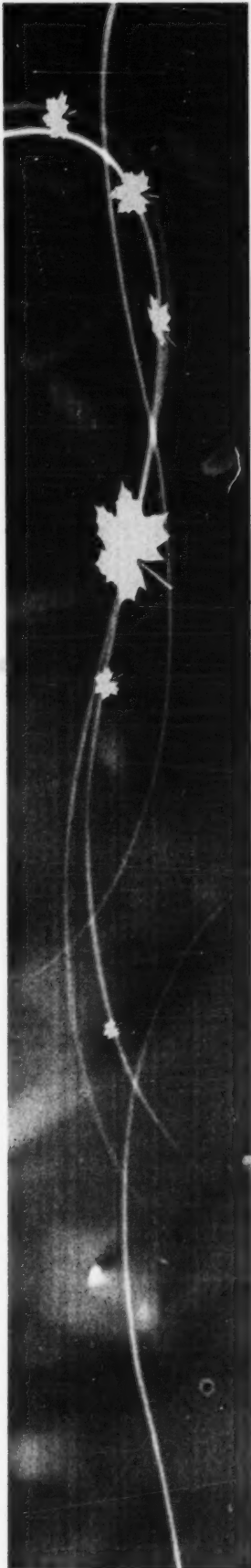




Environment
Canada

Environnement
Canada



A Climate Change Plan for the Purposes of the *Kyoto Protocol Implementation Act*

May 2008

Canada

Library and Archives Canada Cataloguing in Publication

A climate change plan for the purposes of the Kyoto Protocol
Implementation Act 2008 [electronic resource].

Electronic monograph in PDF and HTML format.

Mode of access: World Wide Web.

Issued also in French under title: Plan sur les changements climatiques
pour la Loi de mise en oeuvre du Protocole de Kyoto 2008.

ISBN 978-0-662-46496-9

Cat. no.: En56-183/2008E-PDF

1. Climatic changes--Government policy--Canada. 2. Greenhouse
gas mitigation--Government policy--Canada. 3. Canada. Kyoto Protocol
Implementation Act. 4. Environmental policy--Canada. I. Canada.
Environment Canada.

QC981.8.C5C64 2008

551.6971

C2008-980184-9

For more information:

Environment Canada

Inquiry Centre

70 Crémazie Street

Gatineau, Quebec

K1A 0H3

Telephone: 1 800 668-6767 [in Canada only] or 819-997-2800

Fax: 819-994-1412

TTY: 819-994-0736

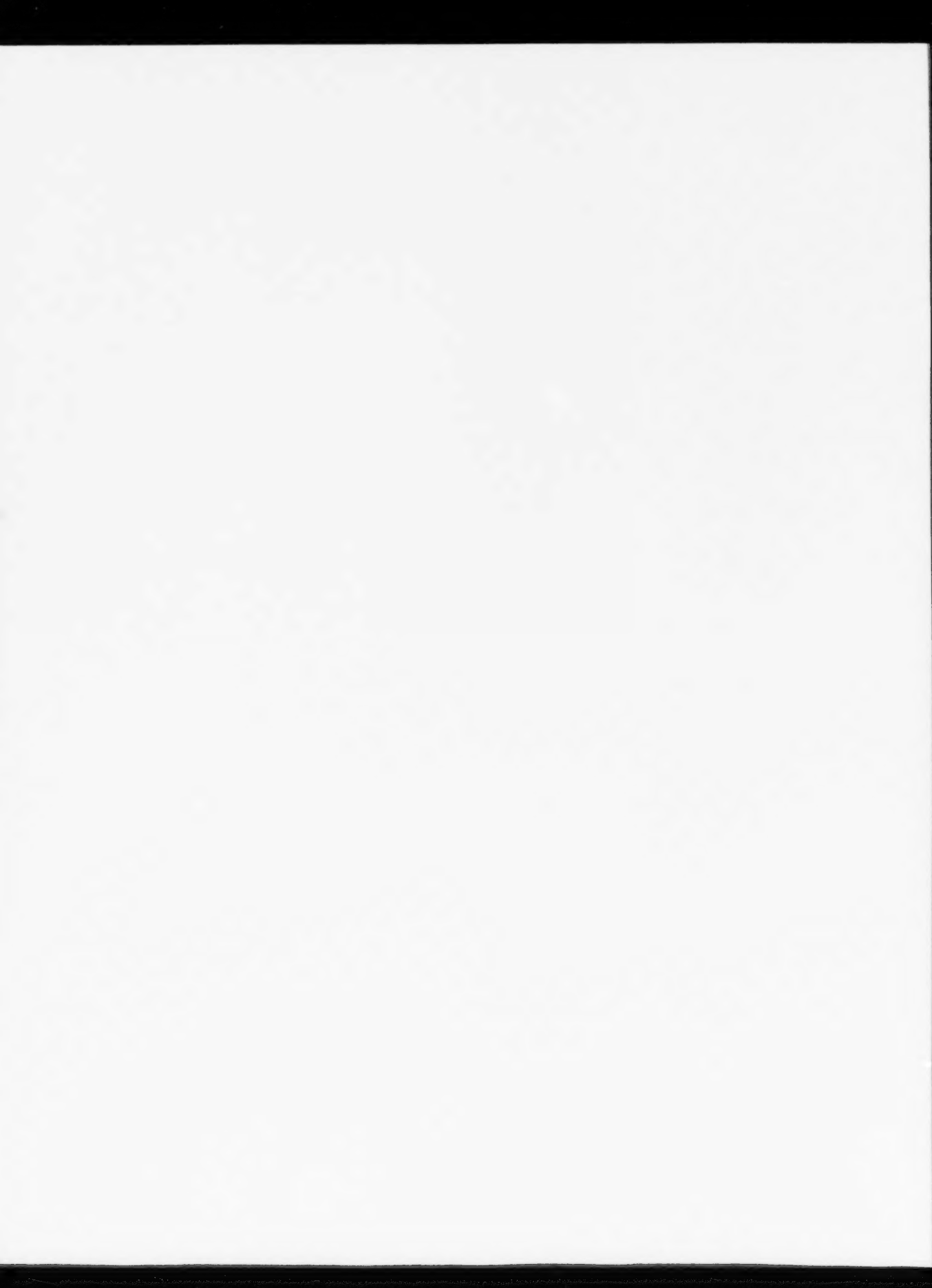
Email: enviroinfo@ec.gc.ca

© Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment, 2008.



Table of Contents

Preface – The <i>Kyoto Protocol Implementation Act</i>	v
Introduction	1
Canada's Kyoto Protocol Targets and Obligations	3
Canada's Greenhouse Gas Emissions in 2006	5
The Economics of the <i>Kyoto Protocol Implementation Act</i>	7
Actions to Address Climate Change	9
Provincial and Territorial Collaboration and Action	22
Conclusion	25
Provision of Comments	26
Annexes	
1. Strengthening the Global Framework for Action	27
2. Methodology	30



Preface – The Kyoto Protocol Implementation Act

On June 22nd, 2007, the *Kyoto Protocol Implementation Act* (KPIA) received Royal Assent. This is the second iteration of the Plan required under the Act, the first having been released on August 21, 2007.

Legal requirements

As per the *Kyoto Protocol Implementation Act*, this Plan fulfills the following legal requirements:

Section 5 of the *Act* provides that "Within 60 days after this *Act* comes into force and not later than May 31 of every year thereafter until 2013, the Minister [of the Environment] shall prepare a Climate Change Plan that includes:

- (a) a description of the measures to be taken to ensure that Canada meets its obligations under Article 3, paragraph 1, of the Kyoto Protocol, including measures respecting:
 - i) regulated emission limits and performance standards,
 - ii) market-based mechanisms such as emissions trading or offsets,
 - iii) spending or fiscal measures or incentives,
 - iii.1) a just transition for workers affected by greenhouse gas emission reductions, and
 - iv) cooperative measures or agreements with provinces, territories or other governments.
- (b) for each measure referred to in paragraph (a),
 - i) the date on which it will come into effect, and
 - ii) the amount of greenhouse gas emission reductions that have resulted or are expected to result for each year up to and including 2012, compared to the levels in the most recently available emission inventory for Canada;
- (c) the projected greenhouse gas emission levels in Canada for each year from 2008 to 2012, taking into account the measures referred to in paragraph (a), and a comparison of those levels with Canada's obligations under Article 3, paragraph 1, of the Kyoto Protocol;
- (d) an equitable distribution of greenhouse gas emission reduction levels among the sectors of the economy that contribute to greenhouse gas emissions"

Additional requirements

Two additional requirements under section 5 of the *Act* are addressed in the 2008 Plan. Paragraphs (e) and (f) of section 5 (1) stipulate that the Government must publish:

- "(e) a report describing the implementation of the Climate Change Plan for the previous calendar year; and
- (f) a statement indicating whether each measure proposed in the Climate Change Plan for the previous calendar year has been implemented by the date projected in the Plan and, if not, an

explanation of the reason why the measure was not implemented and how that failure has been or will be redressed."

Section 9 requires that the Minister of the Environment prepare, within 120 days after the Act comes into force, a statement setting out the greenhouse gas emission reductions that are reasonably expected to result for each year up to and including 2012 from each regulation and measure. No similar requirement exists for the 2008 Plan or any later plan. To review the Statement, please see the 2007 Climate Change Report.

This document constitutes the Climate Change Plan for 2008 that the Government is required to publish under Section 5 of the *Kyoto Protocol Implementation Act*.

Introduction

"Threats to our environment are a clear and present danger that now confronts governments around the world. This is nowhere more evident than in the growing challenge of climate change."

2007 Speech from the Throne

Climate change is the most important environmental issue facing the world today, which is why the Government of Canada is taking comprehensive action to reduce Canada's greenhouse gas emissions.

Addressing climate change in a way that results in real emission reductions in the short, medium and long term, while maintaining the economic growth necessary to sustain and accelerate reductions, requires committed, realistic and balanced efforts based on concrete and practical actions.

Canada faces a number of clear challenges to achieving real reductions in its greenhouse gas emissions, including a growing population and a resource-based economy. These challenges are reflected in the fact that the country's emissions have grown steadily for much of the period since the Kyoto Protocol was signed by a previous government with no plan on how to reach our negotiated target.

In March 2008, the Government released the final *Regulatory Framework for Industrial Greenhouse Gas Emissions*, a key component of *Turning the Corner*, its comprehensive plan to reduce Canada's greenhouse gas emissions. The Framework describes the mandatory regulations to ensure reductions in greenhouse gas emissions from industrial sources. This includes a new requirement for all oil sands upgraders and in-situ plants, as well as coal-fired electricity plants, that come into operation in 2012 or later, to meet a target based on the use of carbon capture and storage technology by 2018. The Government of Canada is taking additional action to achieve additional emissions reductions from the electricity sector by 2020 and is therefore setting up a clean electricity task force to work within the provinces and industry to meet this goal.

Consistent with this Framework, the Government is promoting innovation by stimulating the development and deployment of clean energy and clean transportation technologies, such as carbon capture and storage. Under reasonable assumptions of their future evolution, these measures, combined with ambitious initiatives being undertaken by the provinces and territories, are expected to reduce Canada's greenhouse gas emissions from 2006 levels by 20% by 2020.

This is the second report for the purposes of the *Kyoto Protocol Implementation Act*. The 2008 report details the status of measures first introduced last year while also providing additional details on Canada's carbon emissions footprint and the modeling tools used to make emission reduction calculations. This report also responds to observations made by the National Roundtable on the Environment and the Economy (NRTEE) on last year's report.

While the federal government will provide leadership by requiring reductions in Canada's emissions, provincial and territorial collaboration and action is essential. Provincial governments have already committed to targets that would require achieving greenhouse gas reductions of as much as 300 megatonnes (Mt) by 2020. And there is further action possible in areas where they have important responsibilities, such as building standards, public transit and urban planning.

Alongside domestic actions, Canada is committed to strengthening the global framework for action on climate change. Canada is working with its international partners to develop a global approach to reducing greenhouse gas emissions, one that includes all major emitters and will ensure absolute reductions over the long term. Most recently, at the December 2007 Bali meetings of the United Nations Framework Convention on Climate Change, an important step was taken towards the development of a post-Kyoto climate change agreement when the parties to the Convention adopted the Bali Roadmap, a position supported by this Government. The Government of Canada is contributing actively to negotiations under the Bali Roadmap, with a view to reaching a new agreement by the end of 2009.

Canada's Kyoto Protocol Targets and Obligations

Canada's Commitments under the United Nations Framework Convention on Climate Change and the Kyoto Protocol

The **United Nations Framework Convention on Climate Change (UNFCCC)** is the key multilateral environmental agreement through which national governments are cooperatively addressing climate change. The ultimate objective of the Convention is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level low enough to prevent dangerous human interference with the climate system. A total of 192 countries have ratified the Convention, which entered into force in 1994.

The **Kyoto Protocol** to the UNFCCC, which entered into force in 2005, commits signatory countries (Annex B Parties) to individual targets to limit or reduce their greenhouse gas emissions. Under the terms of the Kyoto Protocol, 38 developed countries, including Canada, made commitments that would cut their total emissions of greenhouse gases on average between 2008 and 2012 to levels 5% below 1990 levels. Canada's target is an average of 6% below 1990 levels over the 2008-2012 period. The Government of Canada has indicated that Canada cannot meet its target for the first Kyoto Protocol commitment period without severe economic disruption. This is due, in large part, to the fact that the country's greenhouse gas emissions have increased significantly since Canada signed the Protocol and that previous governments did nothing to cut our emissions.

Canada has met, and will continue to meet, a series of requirements under the Kyoto Protocol. These include: providing financial assistance to developing countries so that they may endeavour to meet their commitments; submitting periodic "national communications" that include additional information to the information submitted to the UNFCCC; submitting a one-time "Initial Report under the Kyoto Protocol" to facilitate the operation of the first commitment period and describe the required infrastructure that Canada has in place; and, submitting a one-time "Report on Demonstrable Progress under the Kyoto Protocol" outlining the initiatives put in place in Canada to achieve its commitments under the Protocol.

Along with these submissions, Canada has also established a national inventory system for measuring and reporting emissions and removals of greenhouse gases and is establishing a national registry. The registry will serve as a tracking system to ensure accurate accounting of the initial issuance of the amount of greenhouse gas emissions allowed in Canada, and the subsequent international transactions undertaken with other countries.

Timelines for Compliance with the Kyoto Protocol

The first commitment period of the Kyoto Protocol began January 1, 2008, and ends December 31, 2012. Kyoto Protocol Annex B Parties are required to submit their annual greenhouse gas emissions data in the form of a national inventory report, the first of which will be due on April 15, 2010, with the final report for 2012 due on April 15, 2014. The degree to which a Party signatory has met its emissions reduction obligations under the Kyoto Protocol will be assessed after its final report has been filed in 2014.

An Expert Review Team will examine and record each country's total emissions for the commitment period (2008-2012), along with final accounting quantities for land use, land-use change and forestry activities. Once the expert review process has been completed for all Parties, a 100-day "additional period for fulfillment of commitments" will begin. This period is intended to provide Parties with the opportunity to undertake and finalize the transactions necessary to achieve compliance with Article 3, paragraph 1, of the Kyoto Protocol. The specific date when the 100-day period begins will be determined by the Conference of the Parties to the Kyoto Protocol prior to 2014.

Canada's Greenhouse Gas Emissions in 2006

Canada faces distinct economic circumstances that must be recognized in the development of a realistic plan to reduce the country's greenhouse gas emissions over the short, medium and long term. Most significantly, Canada's economy is export-oriented and resources-based, with more than 40% of economic output being exported, and 40% of those exports coming from energy-intensive, resource-based commodities. In all, more than 80% of Canada's greenhouse gas emissions result from the production and use of energy, largely in the areas of stationary fossil fuel combustion (45%) and transportation (27%). Industrial process emissions, emissions from agricultural activities and emissions from waste account for 7.6%, 8.6% and 2.9% of Canada's total greenhouse gas emissions, respectively.¹

While there have been relatively minor and short-lived dips in Canada's historical emissions (for example, in 1991 due to an economic recession, and in 2001 due to the impacts of the terrorist attacks of September 11, 2001), in general, emissions have grown at an average rate of 1.5% from 1990 to 2005.²

Canada's 2006 Greenhouse Gas Emissions

According to the latest National Greenhouse Gas Inventory, total greenhouse gas emissions in Canada in 2006 were about 721 megatonnes (Mt) CO₂ eq. This level is about 29% above Canada's Kyoto Protocol target of an average of 558 Mt CO₂ eq per year for the 2008 to 2012 period.³

Canada's official emission totals for all inventory years (1990-2006) have been reduced by approximately 4-5 Mt as a result of methodological improvements recommended by the UN Expert Review team in February 2008. Along with this adjustment, in March 2008 Statistics Canada released new data for certain key sectors for 2005 and 2006, leading to a further reduction of about 7 Mt from the previously published 2005 emissions estimate and carried through to the calculation of the 2006 estimate.

Renewable emissions in 2006 also dropped slightly for several reasons. First, electricity generation, mainly from coal-fired power plants, fell from 2005, leading to a decrease of 8 Mt. Also, space heating requirements in 2006 further decreased as a result of a warmer winter. Third, efficiency improvements, reduced outputs, and plant closures in some sectors resulted in decreases in industrial sector emissions. For example, emissions in the chemicals industry fell by approximately 12%, or 1 Mt. It is necessary to note that emissions in some areas did grow in 2006, largely due to economic expansion.

According to Statistics Canada, Canadian economic activity, as measured by value added by industry, increased 2.5% in 2007, albeit slowing slightly from the 2006 pace (+2.9%). While the pace of economic growth over the 2008 to 2012 period will be influenced by the value of the Canadian dollar and world crude oil prices, the most recent forecasts of economic growth and energy demand indicate

¹ Initial Report Review, 1990-2005

² Initial Report Review 1990-2005

³ Initial Report Review, 1990-2005

that under a continuing trends scenario, Canada's greenhouse gas emissions will continue to rise⁴. With no new actions from governments or industry to control emissions growth, Canada's greenhouse gas emissions would average some 775 Mt per year between 2008 and 2012. This means that an emission reduction of more than one-third below the continuing trends case, on average, for each year from 2008 to 2012 would be required to achieve Canada's Kyoto Protocol target of 6% below 1990 levels, equivalent to 558 Mt per year.

Canada's Kyoto Protocol Target

In accordance with the UNFCCC, an Expert Review Team (ERT) reviewed Canada's initial report during a visit to Ottawa in November 2007. On February 18, 2008, the ERTI sent an assessment with recommended methodological improvements that, as noted earlier, resulted in a downward revision of emissions about 4-5 Mt for each year of the 1990 to 2004 period.

In the initial report, Canada's Kyoto Protocol base year (1990) emissions were estimated to be 599 Mt. This number has now been revised to 594 Mt, a 0.8% reduction. As a result, Canada's revised Kyoto Protocol target (or its "assigned amount") is 2,792 Mt for the five-year commitment period.

⁴ Business as usual levels refer to the expected levels of economic growth and energy demand that would exist if no new action were to be taken to reduce greenhouse gas emissions.

The Economics of the *Kyoto Protocol Implementation Act*

Under the Kyoto Protocol, parties are required to focus principally on domestic measures to reduce their greenhouse gas emissions, and with good reason. Addressing domestic sources of greenhouse gas emissions not only results in certain and measurable greenhouse gas reductions, but also leads to numerous co-benefits, including reductions in local and regional air pollutants that pose human health and other risks. Over the longer term, reducing emissions at home will also strengthen the energy efficiency and technological competitiveness of businesses and entrepreneurs, thereby better positioning them to compete, and potentially lead, in an increasingly carbon-constrained global economy.

January 1, 2008 ushered in the start of the Kyoto accounting period which runs until December 31, 2012. Meeting Canada's Kyoto Protocol Target of average annual greenhouse gas emissions levels at 6 percent below 1990 levels for each year of the 2008 to 2012 timeframe would require a Canadian effort that is unprecedented anywhere in the world. Among other implications, it would mean the forced turnover of up to a third of the country's existing capital stock (ranging from our automobiles, houses and other structures, through to industrial and other machinery and equipment) in the space of a 5-year period. Even allowing for the purchase of international emission credits from such sources as Kyoto's Clean Development Mechanism, achieving this degree of forced economic restructuring would require draconian government measures, equivalent to an immediate and very steep tax on all forms of fossil fuel energy consumed across the economy, from large industrial emitters of greenhouse gases to individual Canadians.

In April, 2007, the Government of Canada published an analysis of what measures would be necessary for Canada to meet its Kyoto target at this late juncture. That analysis, endorsed by some of Canada's leading economists, found that, in the face of a virtually unchecked rise in greenhouse gas emissions since the Kyoto Protocol was signed by Canada, meeting Canada's Kyoto Protocol target as intended by the *Kyoto Protocol Implementation Act* could not be achieved without imposing an untenable burden on the Canadian economy. A detailed account of the Government's analysis of the implications of meeting the *Kyoto Protocol Implementation Act* can be found in the Government's Report entitled *The Cost of Bill C-288 to Canadian Families and Business* at http://www.ec.gc.ca/doc/media/m_123/toc_eng.html

The Government's analysis indicated that Canadian Gross Domestic Product (GDP) would decline by more than 6.5% relative to current projections in 2008 as a result of strict adherence to the Kyoto Protocol's emission reduction target for Canada. This would imply a deep recession in 2008, with a one-year net loss of national economic activity in the range of \$51 billion relative to 2007 levels. By way of comparison, the most severe recession in the post-World War II period for Canada, as measured by the fall in real GDP, was in 1981-1982. Real GDP fell 4.9% between the second quarter of 1981 and the fourth quarter of 1982.

All provinces and sectors would experience significant declines in economic activity under this scenario, while employment levels would fall by about 1.7% (or 276,000 jobs) between 2007 and 2009. In addition, there would be a reduction of real per capita personal disposable income levels from forecast levels of around 2.5% in 2009 (or about \$1,000 per Canadian in today's dollars).

Meeting Canada's Kyoto Protocol target on the timeline proposed in the *Kyoto Protocol Implementation Act* would also have implications for energy prices faced by Canadian consumers. Natural gas prices could potentially more than double in the early years of the 2008-2012 period, while electricity prices could rise by about 50% on average after 2010. Prices for transportation fuels would also inevitably rise by a large margin – roughly 60%.

The majority of other recent studies examining the implications of Canada's meeting its Kyoto Protocol target support the overall conclusion of the Government's study. Canada has simply run out of time to meet its Kyoto Protocol target in a manner which does not result in punitive damage to the Canadian economy and the quality of life of citizens.

The Government's economic analysis of the *Kyoto Protocol Implementation Act* demonstrates the importance of implementing an effective, long-term approach to achieve deep reductions in our greenhouse gas emissions. It would be irresponsible for any government to risk the livelihoods of Canadian families and businesses in an effort to achieve only short term progress, and indeed the economic damage that such a policy would produce would cripple our capacity to support the investments and technological change required to address climate change in a meaningful way over the long-term.

This is a core principle that underlies the balanced, realistic climate change plan for Canada that is detailed in the Government's *Turning the Corner* framework, as released in April of 2007. *Turning the Corner* commits the Government of Canada to reduce Canada's greenhouse gas emissions by 20% by 2020 in a manner that balances manageable economic costs with significant immediate and long-term emissions reductions.

Actions to Address Climate Change⁵

The Government of Canada is committed to stopping the increase in Canada's greenhouse gas emissions and drastically reducing them. The Government of Canada has established a national target of an absolute 20% reduction in greenhouse gases, relative to 2006 levels, by 2020. Under current forecast assumptions total reductions required to meet this target will be in the range of 330 Mt in 2020. This is equal to eliminating the combined greenhouse gas emissions from Alberta, Quebec and Newfoundland and Labrador. Over the longer term, the Government is committed to achieving a 60 to 70% reduction from 2006 levels by 2050.

In April 2007, the Government released its *Turning the Corner* action plan for reducing greenhouse gas emissions and air pollution. Since then, the Government has consulted with provinces, environmental groups and industry to finalize the details of its plan.

To achieve these reductions, the Government is implementing an appropriate range of regulatory and program measures, which will provide the necessary incentives for firms and individuals to adopt currently available green or low-carbon technologies, as well as developing new ones.

As explained in the report for 2007, the Government's *Turning the Corner* plan will drive real reductions in the country's emissions through the regulation of a number of key sectors, as well as by implementing program measures that will promote the development and deployment of green, low-carbon technologies. All of the measures described below have been fully implemented with the noted exceptions of the regulations for: industrial greenhouse gas emissions, rail, air and marine, renewable fuel content in gasoline, energy efficiency of certain products and fuel consumption in vehicles. In addition, the vehicle scrappage and marine shore power programs are not yet fully implemented.

When the first report was developed, pursuant to the requirements of paragraph 5 (1) (a) (iii.1) regarding measures respecting a just transition for workers affected by greenhouse gas emission reductions, the Government considered the requirement and determined that the implementation of regulatory or other measures proposed in this report will not require significant worker adjustment in regulated industries. Since 2007 this position has not changed, and the Government is not bringing forward any specific measures at this time.

The Regulatory Framework for Industrial Greenhouse Gas Emissions

The following provisions address the requirements of paragraphs 5 (1) (a) (i) and (ii) of the *Kyoto Protocol Implementation Act* as well as paragraphs 5 (1) (b) (i) and (ii), (e) and (f).

The *Framework* has two key components: (1) stringent and mandatory short, medium and long term emissions reduction targets, relative to 2006 emissions; and, (2) compliance mechanisms that provide firms with flexibility in how they meet their targets.

⁵ Please note that there may be discrepancies between the 2007 and 2008 reports in terms of estimated emission reductions for the Government's measures. These are primarily due to improvements in methodology by departments.

Greenhouse Gas Emission Reduction Targets

The finalized Framework set an initial required reduction of 18% from 2006 emission intensity levels in 2010 for existing facilities. Every year thereafter, a 2% continuous improvement in emission intensity will be required. By 2015, therefore, an emission-intensity reduction of 26% from 2006 levels will be required, with a further reduction to 33% by 2020. The emission-intensity approach ties the emission reduction targets to production. This allows emission reductions to be achieved while supporting economic growth.

New facilities, which are defined as those whose first year of operation is 2004 or later, will be granted a three-year commissioning period before they will face an emission-intensity reduction target. After the third year, new facilities will be required to improve their emission intensity each year by 2%. A cleaner fuel standard will be applied, thereby setting the target as if they were using the designated fuel. A flexible approach will be taken in special cases where the equipment or technology used in a new plant facilitates carbon capture and storage or otherwise offers a significant and imminent potential for emission reductions.

For both existing and new facilities, fixed process emissions, which are emissions tied to production and for which there is no alternative reduction technology, will receive a 0% target in the regulations. In other words, for these types of emissions, there is no way, with current technology, for them to be reduced except by shutting down production.

The final *Regulatory Framework* released in 2008, included several new provisions which were not a part of the April 2007 announcement:

- All oil sands upgraders and in-situ plants that come into operation in 2012 or after will be required to meet a stringent target based on the use of carbon capture and storage by 2018
- All coal-fired electricity plants that come into operation in 2012 or after will be required to meet a stringent target based on the use of carbon capture and storage by 2018.
- The federal government will establish a clean electricity task force to work with Canada's provinces and territories, as well as with industry to meet an additional 25 Mt reduction goal from the electricity sector by 2020.

In the October 2006 *Notice of intent to develop and implement regulations and other measures to reduce air emissions*, the government indicated its intention to move from emission-intensity targets to fixed emission caps in the 2020-2025 period. The government still intends this transition to take place.

The anchor for the fixed cap will be the national objective of a 20% absolute reduction in greenhouse gas emissions from 2006 levels by 2020. The level of the cap on industrial emitters will be informed by the results of the application of the emission-intensity system.

As well, any decision in Canada on the transition to a fixed-cap regime for greenhouse gas emissions would take into account developments occurring in other countries, especially the United States, with the aim of establishing a North American emissions trading system once the United States implements a greenhouse gas regulatory system.

Complying with Regulated Targets

In order to promote investments in important green technologies and facilitate the transition from intensity-based to hard emissions caps, firms can comply with the regulations either by reducing their

own emissions through abatement actions or by making use of one of the Framework's compliance mechanisms, detailed below.

Inter-firm trading: Firms whose actual emission intensity in a given year is below their target will receive tradable credits equal to the difference between their target and their actual emission intensity, multiplied by their production in that year. These credits can be banked for future use or sold to other parties, including other regulated firms.

Offset System: Offsets are projects that result in incremental real, verified domestic reductions or removals of greenhouse gas emissions in activities that are not covered by the federal greenhouse gas regulations. These projects will generate credits that firms can use for compliance purposes.

Clean Development Mechanism: Firms can use certain credits from the Kyoto Protocol's Clean Development Mechanism. Access to these credits for compliance purposes will be limited to 10% of each firm's total target.

One-time credit for early action: Firms that took verified action between 1992 and 2006 to reduce their greenhouse gas emissions will be eligible to apply for a share of a one-time credit for early action. A maximum of 15 Mt worth of credits will be allocated, with no more than 5 Mt to be used in any one year. Firms will be required to submit evidence of changes in processes or facility improvements they had undertaken that resulted in verifiable, incremental greenhouse gas emission reductions. The maximum allocation for emission reductions will be one credit for each tonne of carbon dioxide equivalent reduction. If the total tonnage of emission reductions applied for were to exceed 15 Mt, the credits will be distributed to individual firms in proportion to their contribution to the total emission reduction achieved.

Technology fund: Firms can obtain credits for compliance purposes by contributing to a technology fund. The fund will be a means to promote the development, deployment, and diffusion of technologies that reduce emissions of greenhouse gases across industry. A third-party entity, at arm's-length from government, will be created to administer the fund. A key principle is that there will be no inter-regional transfer of wealth.

Contributions to the deployment-and-infrastructure component of the fund, aimed at investments with a high likelihood of yielding greenhouse gas emission reductions in the near term, will be limited to 70% of the target in 2010, falling to 65% in 2011, 60% in 2012, 55% in 2013, 50% in 2014, 40% in 2015, 10% in 2016, and 10% in 2017. No further contributions will be accepted after 2017. The research and development component, which will focus on projects aimed at supporting the creation of transformative technologies, will be limited to 5 Mt each year, also ending after 2017.

From 2010 to 2012, the contribution rate for the fund will be \$15 per tonne of carbon dioxide equivalent. In 2013, the contribution rate will be \$20 per tonne. Thereafter, the rate will escalate yearly at the rate of growth of nominal GDP until 2017.

Pre-certified investments: As an alternative to contributing directly to the technology fund, under the pre-certified investment option, a firm will be eligible to receive credits for investing directly in large-scale and transformative projects, either its own or joint-venture projects, selected by the firm from a menu set out by the federal government.

Pre-certified investments will have the same contribution rate as the technology fund and will be subject to equivalent criteria and requirements, including ownership provisions.

To facilitate the implementation of carbon capture and storage in new facilities, the Government will start discussions with industry, as well as the Governments of Alberta and Saskatchewan, to pre-certify carbon capture and storage projects. The use of such pre-certified investments will ensure that funds from such sectors as oil and gas will be dedicated to emission reductions from those sectors.

In addition, because of the significant potential for carbon capture and storage to reduce emissions and in order to encourage investment in such projects, contributions of up to 100% of a firm's regulatory obligation in these pre-certified projects will qualify for credits up to 2018. This provision will be limited to firms that can make direct use of carbon capture and storage technology in the following sectors: oil sands, electricity, chemicals, fertilizers, and petroleum refining.

Unintentional fugitive methane emissions from sources such as equipment leaks and storage from the upstream oil and gas and oil sands sector and natural gas transmission, distribution, and storage facilities were not identified as covered sources in the April 2007 framework. Reduction requirements for these sources will be implemented through regulated codes of practices. Likewise, regulated codes of practices will be implemented to reduce hydrofluorocarbon emissions from industrial processes and industrial product use and from other applications, such as refrigeration, and air conditioning.

Regulatory Framework for Industrial Greenhouse Gas Emissions					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)⁶	0	0	52	55	56

Regulating Energy Efficiency — Strengthening Energy Efficiency Standards

The Government intends to amend energy efficiency regulations under the *Energy Efficiency Act*. This will include the introduction of new performance requirements for 20 currently unregulated products, such as commercial clothes washers and commercial boilers, and tightened requirements for ten products, such as residential dishwashers and dehumidifiers, for which efficiency standards are already in place. The measure started on April 1, 2007.

Before issuing new standards, the Government of Canada is working with provinces and territories as well as stakeholders to identify fair and meaningful standards. New standards will take effect following the enacting of amendments to Energy Efficiency Regulations. To date, pre-publication for future standards for ten products and labeling for incandescent and fluorescent lamps were released in December 2007. Further amendments to Energy Efficiency Regulations were pre-published in March 2008 and work is progressing on schedule for the addition of further products in December 2008 and December 2010.

While energy efficiency standards take the worst performing equipment out of the marketplace entirely, ENERGY STAR labelling complements the standards by leading consumers to the best performing equipment. In fact, a recent survey found that 84% of Canadian consumers who have or who were planning to buy home electronics say that the fact that the products are ENERGY STAR qualified impacts on their purchasing decision.

⁶ The estimated emission reductions are based on the targets contained in the final Regulatory Framework released in 2008. Actual industrial emission levels will depend on the compliance options chosen by regulated firms.

The Government is also developing regulations under the *Energy Efficiency Act* that will phase out the use of inefficient incandescent light bulbs in most areas of regular use by 2012. The greenhouse gas emission reductions associated with this measure are captured as a part of the reductions in the chart below.

Energy Efficiency Regulations and Phasing Out Inefficient Incandescent Lightbulbs ⁷					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.36	0.88	1.23	1.54	4.07

Regulating Transportation

Fuel Efficiency of New Cars and Light Trucks

The Government is currently developing regulations for the fuel consumption of cars and light trucks sold in Canada under the *Motor Vehicle Fuel Consumption Standards Act*. The regulations will be benchmarked against a stringent, dominant North American standard. As the regulations for fuel consumption are still being developed, the Government is not in a position to provide expected emission reductions.

Reducing Emissions from Rail, Air and Marine Transportation

The Government will develop and implement new regulations coming into effect in 2011 under the *Railway Safety Act* to reduce air emissions from the rail industry in Canada. In the meantime, the Government supports a Memorandum of Understanding that has been signed with the Railway Association of Canada that ensures that the rail industry continues to reduce its emissions of greenhouse gases between 2007 and 2010. As the regulations are still being developed, the Government is not in a position to provide expected emissions reductions.

The Government will also support the development of international standards and recommended practices with the International Civil Aviation Organization concerning emissions from aviation sources. These standards and recommended practices will be considered in the development of domestic regulations under the *Aeronautics Act*. As the standards are still being developed, the Government is not in a position to provide expected emissions reductions.

Regulating Renewable Fuels Content

The Government currently has Bill C-33, An Act to amend the *Canadian Environment Protection Act*, 1999, before the House of Commons. The Bill would amend CEPA 1999 to provide the additional authorities needed to make efficient national regulations requiring renewable content in Canadian fuels.

In December 2006, the Government announced its intention to regulate the mandatory renewable content of fuels in Canada. Regulations under CEPA 1999 will require fuel producers and importers to have an average annual renewable fuel content of at least 5% of the volume of gasoline that they

⁷ This estimate includes the reductions expected from the Government's efforts to regulate incandescent light bulbs as described below.

produce or import, commencing in 2010. In addition, the Government intends to require an average 2% renewable fuel content in diesel fuel and heating oil, no later than 2012, upon successful demonstration of renewable diesel fuel use under the range of Canadian conditions.

Supporting Renewable Fuels Development

In addition to increasing the availability of renewable fuels through regulations, the Government's Renewable Fuels Strategy includes other components. The ecoENERGY for Biofuels Initiative supports the production of renewable alternatives to gasoline and diesel and encourages the development of a competitive domestic industry for renewable fuels. EcoENERGY for Biofuels will invest up to \$1.5 billion over nine years in support of biofuels production in Canada. The ecoAGRICULTURE Biofuels Capital Initiative (ecoABC) which is a new \$200 million initiative to provide repayable contributions of up to \$25 million per project to help farmers overcome the challenges of raising the capital necessary for the construction or expansion of biofuel production facilities has been operational since April 2007. Thus far, four contribution agreements have been entered into, worth approximately \$34.6 million.

Announced in 2006, the Biofuels Opportunities for Producers Initiative assisted agricultural producers in developing sound business proposals, and, undertaking feasibility or other studies to expand biofuels production capacity. The initiative ended March 2008. During the duration of the program, 121 projects were supported for a total of \$18.2 million.

Finally, an additional \$500 million is being provided to Sustainable Development Technology Canada to invest with the private sector in establishing large-scale facilities for the production of next-generation renewable fuels. Reductions under these measures have already been accounted for in the expected reductions for Regulating Renewable Fuels Content.

Through Budget 2008, the Government is building upon its previous investments in renewable fuels development in Canada. The Budget provides \$10 million over two years for scientific research and analysis on biofuels emissions to support regulations development and demonstration projects to verify that renewable diesel fuel is safe and effective for the Canadians climate. The Budget also provides funding to establish a pilot program to demonstrate E85 fuelling infrastructure and promote its commercialization. E85 is a renewable fuel containing 85% ethanol and 15% gasoline.

Regulating Renewable Fuels Content					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0	0	0.8	0.8	1.9

ecoACTION Investments

As a means to support these regulatory actions and further reduce greenhouse gas emissions, the Government is investing in a series of ecoACTION programs intended to promote the development and deployment of new technologies. This section outlines ecoACTION programs including: ecoENERGY, ecoTRANSPORT and ecoAGRICULTURE.

The following sections detailing ecoACTION investments address the requirements of paragraph 5 (1) (a) (iii) of the *Kyoto Protocol Implementation Act* as well as paragraphs 5 (1) (b) (i) and (ii), (e) and (f).

ecoENERGY Initiatives

The **ecoENERGY Technology** Initiative is investing \$230 million over 4 years (2007-11) in the research, development and demonstration of clean transformational energy technologies and systems. Given the longer term nature of this project, the investment is expected to lead to reductions in greenhouse gas emissions in the post-2012 period. The Initiative is directed towards increasing clean energy supplies, reducing energy waste and reducing pollution from conventional energy.

In April 2008, Calls for Proposals were issued in two areas: 1) technology development to reduce the environmental impact of oil sands (\$15 million); and, 2) carbon capture and storage technologies to reduce greenhouse gas emissions from oil sands and coal-fired electricity plants (\$125 million). Companies, individually or in private-sector consortia, conducting or capable of conducting energy-related R&D or technology demonstrations in Canada, and company-led public-private sector teams involving provincial, territorial and/or municipal governments and agencies, and/or Canadian universities and colleges, were invited to submit Expressions of Interest Proposals for R&D and demonstration projects in these two areas. These calls closed on May 2, 2008.

Selected projects resulting from the call process are anticipated to begin in Fall 2008.

The **ecoENERGY for Renewable Power** program is investing \$1.48 billion to provide incentives to increase Canada's supply of clean electricity from renewable sources such as wind, biomass, low-impact hydro, geothermal, solar photovoltaic and ocean energy. This measure started on April 1, 2007 and will end on March 31, 2011. The program will provide an incentive of 1 cent/kWh for up to 10 years to qualifying projects.

The program is in its second year of operation and is fully implemented. In fiscal year 2007/08, contribution agreements for 12 projects were signed (representing approximately 950 MW and investments of \$305 million over ten years).

ecoENERGY for Renewable Power					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	2.2	3.74	5.45	6.67	6.67

The **ecoENERGY for Renewable Heat** initiative is investing approximately \$36 million over 4 years in incentives and industry development to support the adoption of clean renewable thermal technologies such as solar air and solar hot water for water and space heating in buildings. This measure started on April 1, 2007 and will end on March 31, 2011.

The initiative is in its second year of operation and is fully implemented. In fiscal year 2007/08, over 200 contribution agreements were signed with a total incentive value of about \$6 million for the deployment of solar air and water heating systems into the commercial, industrial and institutional sectors.

ecoENERGY for Renewable Heat					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.005	0.01	0.015	0.02	0.02

The **ecoENERGY for Buildings and Houses** program is investing \$60 million over 4 years to encourage the construction and operation of more energy-efficient buildings and houses using complementary activities such as rating, labelling and training. The program started on April 1, 2007.

In 2007-08, NRCan issued more than 6,662 labels for new houses and 102,845 for existing houses. Pilot projects have been initiated with three municipalities to investigate building labelling, which are of interest to many provinces and supports collaborative work between NRCan and the provinces to update the model national energy code for buildings. Four provinces have active projects related to increasing the stringency of the code. In addition, regarding houses, six provinces have announced changes to building codes to achieve an energy efficiency rating of 80 on NRCan's EnerGuide Rating System.

ecoENERGY for Buildings and Houses					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.32	0.56	1.13	1.57	2.02

The **ecoENERGY Retrofit Initiative** is investing \$220 million over 4 years to provide financial support and information to encourage retrofitting by home owners, small and medium sized businesses, public institutions and industrial facilities. The program was launched on April 1, 2007.

In 2007-08, 102,800 homes had pre-retrofit energy evaluations and 17,000 homeowners received grants averaging about \$1000 each. All regions of Canada except one territory have matching programs where homeowners can get seamless access to both orders of government support for home retrofits. The federal program facilitates access for provincial or utility low-income programs to maximize uptake from this community.

96 retrofit projects were funded in small and medium organizations representing fewer than 500 employees (industry) or less than 10,000 sq metres (buildings) for total expected savings of approximately 30 kilotonnes.

ecoENERGY Retrofit Initiative					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.44	0.69	0.94	1.00	1.00

The **ecoENERGY for Industry** program is investing \$18 million over 4 years to encourage information-sharing on new technologies and best practices in energy use, as well as training and specialized assessments for energy managers to identify and implement energy-saving projects. The program is in its second year of operation and is fully implemented.

In 2007-08, 1,200 industrial participants attended *Dollars to Sense* training workshops - adding to the approximately 14,000 trained since 1997. In addition, 138 new companies joined the program to find energy and emission-saving help. Three benchmarking studies were completed or are underway (cement, textiles, metal finishing and pulp and paper) along with six in-depth assessments to find savings opportunities (e.g. computational fluid dynamics assessments, process integration studies, combustion analysis). Two projects were initiated as part of a federal-provincial collaboration on energy management standards and information systems.

ecoENERGY for Industry					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.17	0.27	0.37	0.4	0.4

ecoTRANSPORT Initiatives

ecoAUTO Rebate Program

The ecoAUTO Rebate Program, administered by Transport Canada, provides a cash incentive to Canadians to help the environment by buying or leasing more fuel-efficient vehicles. Through this initiative, the federal government offers rebates from \$1,000 to \$2,000 towards the purchase or lease (12 months or more) of new fuel-efficient vehicles for the model years 2006, 2007 and 2008. Only new eligible vehicles purchased or leased as of March 20, 2007 will qualify for the rebate.

Under this measure, vehicles whose combined fuel consumption (55% city, 45% highway) are at or below the program's fuel consumption targets of 6.5 l/100km for cars and 8.3 L/100km for light trucks are eligible for a rebate of up to \$2,000. Flex-fuel passenger vehicles, which are capable of operating with either gasoline or a fuel blend of 15% gasoline and 85% ethanol (E85), receive a rebate of \$1,000 if their E85 combined fuel consumption rating is no more than 13.0 L/100km.

The 2008 Federal Budget announced that the ecoAUTO rebate program would not be available beyond the 2008 model year. Consumers will continue to be able to submit application for the rebate until March 31, 2009, on eligible 2006, 2007 and 2008 model year vehicles purchased by December 31, 2008. The impacts of the ecoAUTO rebate program are estimated to extend beyond the March 2009 end of the program, as the fuel efficient vehicles purchased will remain in use for a number of years beyond this date.

ecoAUTO Rebate Program					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.03	0.02	0.02	0.02	0.02

Green Levy

The Green Levy applies to passenger vehicles with a fuel consumption rating of 13 litres or more per 100 kilometres (55% city and 45% highway) and is imposed at rates ranging from \$1,000 to \$4,000. The Green Levy is payable by the manufacturer or importer of new vehicles delivered after March 19, 2007 and by the importer of used vehicles, if the used vehicle was originally put into service

(in any jurisdiction) after March 19, 2007. The Canada Revenue Agency and the Canada Border Services Agency are responsible for the administration of the Green Levy, working with manufacturers and importers of vehicles to facilitate its application.

Green Levy					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.10	0.14	0.17	0.20	0.23

The **ecoENERGY for Personal Vehicles Initiative** is investing \$21 million over 4 years to provide information to consumers on fuel consumption and decision-making tools such as vehicle labels, guides and information, to encourage more fuel efficient buying, driving and maintenance practices. It also supports the Memorandum of Understanding that has been signed between the auto industry and the Government of Canada. Work on the interim goal progress report, to be released in 2008-09, is underway. The program was launched on April 1, 2007.

Through the ecoENERGY for Personal Vehicles driver education initiative, 350,000 novice drivers were trained in fuel efficient driving practices in 2007-08. Collaborative agreements were initiated with the New Brunswick Lung Association, the Rubber Association, Pollution Probe and others to promote efficient driving and vehicle maintenance practices to targeted audiences. The Fuel Consumption Guide rating the fuel efficiency of all light duty vehicles was released to over 3000 auto dealerships across Canada, as well as on the web, and best-in-class efficiency awards were presented at the Toronto international auto show.

ecoENERGY for Personal Vehicles Initiative					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.025	0.05	0.075	0.1	0.1

The **ecoMOBILITY Initiative** is investing \$10 million over 4 years to provide financial support to municipalities and regional transportation authorities for transportation demand management (TDM) projects that reduce emissions by shifting personal automobile travel to other modes, reducing the number and length of car trips, and shifting trips to less congested times and routes. The program will also help build national capacity to implement TDM measures through research, training and the development of resources.

National consultations were held in Summer and Fall 2007 on the design and implementation of the program. A request for proposals to initiate innovative transportation demand projects in municipalities was launched in February 2008, with successful projects to be announced in Summer/Fall 2008. Complementary national initiatives will be rolled out in 2008/09, drawing upon a national advisory group composed of key stakeholders.

It is important to note that ecoMOBILITY builds on major urban transit infrastructure investments, including those that are anticipated under the Government of Canada's infrastructure funding. Emission reductions beginning in 2009 will be reliant on such investments taking place.

ecoMOBILITY Initiative					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0	1.236	1.631	1.653	1.675

The **National Vehicle Scrappage Program** is investing \$90.5 million over the next 3 years to encourage the voluntary removal of older vehicles from Canadian roads. It is expected that by the end of fiscal year 2008-09, the program will be launched in all provinces. Because older vehicles were subject to less stringent smog-forming emission standards, they contribute disproportionately to air pollution. In addition to reducing smog-forming emissions, by encouraging Canadians to adopt sustainable transportation options when they retire their old vehicles, this program will also achieve reductions of greenhouse gas emissions.

National Vehicle Scrappage Program					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0	0.043	0.093	0.069	0.003

The **ecoTECHNOLOGY for Vehicles Program** is investing \$15 million over 4 years to support in-depth testing and publishing of the safety and environmental performance of a range of emerging technologies for use in light-duty vehicles. In addition to showcasing these new environmentally friendly technologies at auto shows across the country and helping provide Canadians with the facts they need, the program will also foster important new partnerships with the automobile industry and others across the country to help identify and take action on barriers to the introduction of environmental technologies in Canada. The ecoTECHNOLOGY for Vehicles Program builds on measures announced in the fall by Government of Canada to regulate the fuel consumption of the auto sector and supports the achievement of the target set in the MOU on emission reduction signed with the auto industry.

In 2007/08 the program began evaluations of two electric vehicles, acquired two retrofitted plug-in hybrid vehicles for testing, participated in over 20 events to promote advanced technologies and is developing a partnership with Hydrogen Fuel Cell Canada to acquire a hydrogen fuel cell vehicle for testing and showcasing. Acquisition of other technologies, such as Hydrogen and Compressed Natural Gas (CNG), is also planned for future program years.

ecoTECHNOLOGY for Vehicles Program					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0	0.36	0.50	0.70	0.91

The **ecoENERGY for Fleets** initiative is investing \$22 million over 4 years to generate reductions in fuel use and related costs, air pollutants and greenhouse gas emissions through measures targeted at both operators and managers of Canada's commercial and institutional road vehicle fleets. The program was launched on April 1, 2007.

Under this program, in 2007-08, 62 truck stops participated in idle reduction campaigns, 423 school bus drivers were trained in SmartDriver practices and a new collaboration was launched focusing on efficiency in the forest sector fleet. A federal-provincial collaboration was also initiated on best practices and rating systems for heavy duty vehicles (class 8 trucks and equipment).

ecoENERGY for Fleets					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.22	0.34	0.47	0.5	0.5

The Government is investing \$33 million over 4 years in four initiatives under the **ecoFREIGHT** program to test new freight technologies and remove financial barriers to their adoption. These initiatives include the **National Harmonization Initiative for the Trucking Industry** (\$6 million), the **Freight Technology Demonstration Fund** (\$10 million), the **Freight Technology Incentives** (\$10 million) and the **ecoFREIGHT Partnership Initiative** (\$7 million).

- The National Harmonization Initiative for the Trucking Industry: identifies regulatory barriers and solutions in collaboration with provinces and territories, so that the Canadian trucking industry can embrace emissions-reducing technologies.
- The Freight Technology Demonstration Fund: establishes cost-shared demonstrations to test and measure new and underused freight transportation technologies in real-world conditions.
- The Freight Technology Incentives Program: provides cost-shared funding to companies and non-profit organizations in freight transportation to help them to purchase and install proven emission-reducing technologies.
- The ecoFREIGHT Partnerships: builds and maintaining partnerships within the transportation sector to reduce emissions from freight transportation through fast and flexible voluntary actions that can support the Framework.

The National Harmonization Initiative for the Trucking Industry has been initiated through working committees of the Council of Ministers Responsible for Transportation and Highways.

The first projects under the Freight Technology Demonstration Fund and Freight Technology Incentives Programs were announced on May 6th, 2008, providing \$6.1 million in funding for 23 projects.

The ecoFREIGHT Partnerships program is fully operational with implementation of the MOU with the Canadian air and rail industry associations. Annual reports were received by these two associations, reporting on progress achieved under the MOU. Both the air and rail sectors are on track with their emissions reduction targets.

ecoFREIGHT Program					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0	0.65	1.19	1.22	1.26

The Marine Shore Power Program is investing up to \$6 million over 4 years to demonstrate the use of shore-based power for marine vessels in Canadian ports to reduce air pollution from idling ship engines in some of Canada's largest urban centres. Following consultations with industry in Fall 2007, it was decided to delay the program launch date until after planned amendments to the *Canadian Marine Act* come into force which would make Canadian Port Authorities eligible for funding. Therefore the due date for applications for Round 1 funding is tentatively scheduled for later in 2008.

Marine Shore Power Program					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0	0.005	0.007	0.007	0.008

Promoting Sustainable Urban Transit

The **Public Transit Tax Credit (PTTC)** allows individuals to claim a non-refundable income tax credit for the cost of monthly public transit passes or those passes of a longer duration, effective July 1, 2006. The PTTC was extended in Budget 2007 to electronic fare cards and weekly passes when used on an ongoing basis. The objectives for the measure outlined in Budget 2006 were to provide assistance to Canadians by making transit more affordable, to reduce traffic congestion in urban areas and to improve the environment by lowering greenhouse gas emissions.

In Budget 2008, the Government also committed \$500 million in year-end funding to support public transit capital investments. This is on top of the \$1.3 billion for public transit capital investments in Budget 2006. Of these funds, \$900 million was earmarked to provinces and territories through the Public Transit Capital Trust, a one-time investment paid through a third-party trust. The remaining \$400 million was designed to accelerate provincial and territorial investments in public transit infrastructure. The Government is not in a position to calculate firm reduction totals for the infrastructure funding described above.

Public Transit Tax Credit					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	0.031	0.033	0.035	0.036	0.038

ecoAGRICULTURE Initiatives

Announced in 2006, the \$365 million Agricultural Bioproducts Innovation Program has to date received a total of 78 eligible Full Network Proposals. The Agri-Opportunities Program became operational in January 2007 and since that time, ten projects worth \$23.0 million have been approved. Regarding the Co-operative Development Initiative (CDI), in 2006 a component was added to the CDI to focus on biofuels and value added activities for agricultural production. This component is scheduled to end in March 2009. In 2007, nine biofuel projects involving a total contribution of \$380,490 were approved. Reductions under these measures have already been accounted for in the expected reductions for Regulating Renewable Fuels Content.

Provincial and Territorial Collaboration and Action

Provinces, territories and municipalities control many of the important levers for making significant reductions in greenhouse gas emissions from particular sectors. These sectors include, among others, electricity generation, residential, commercial and institutional buildings, transportation, agriculture, and waste management. Over 85% of Canada's total greenhouse gas emissions are emissions in areas under sole or partial provincial / territorial responsibility.

Provincial governments have already committed to targets that would require achieving greenhouse gas reductions of as much as 300 Mt by 2020. Over 200 provincial initiatives have been announced to date to begin achieving those goals. While some of those initiatives overlap with federal actions, the Government's modelled estimate indicates that they will provide an incremental 40 Mt in emissions reductions by 2020. Most provinces have indicated that they are planning to do even more to meet their own targets.

The Government of Canada firmly believes that it is realistic and achievable for provinces and territories to take further action in areas where they have important responsibilities, such as building standards, public transit and urban planning. The Government expects that the provinces and territories will introduce new measures that will result, at minimum, in an additional 35 Mt of reductions in greenhouse gas emissions. This will enable Canada to not only meet, but potentially surpass its national target of a 20% reduction in emissions from 2006 levels by 2020.

Federal Collaborative Initiatives

This section on federal collaborative initiatives addresses the descriptive requirements of paragraph 5 (1) (a) (iv) of the *Kyoto Protocol Implementation Act* to include measures respecting cooperative measures or agreements with provinces, territories or other governments as well as paragraphs 5 (1) (b) (i) and (ii).

In Budget 2007, the federal government put in place an important instrument for collaboration across jurisdictions on climate change policy. Under the \$1.5 billion **Clean Air and Climate Change Trust Fund**, a trust has been established to directly support provincial and territorial efforts to develop technology, improve energy efficiency, and undertake other projects that will result in significant environmental benefits.

The Trust Fund is expected to result in the following reductions in greenhouse gas emissions.

Clean Air and Climate Change Trust Fund					
Year	2008	2009	2010	2011	2012
Preliminary Expected Reductions (Mt)	16	16	16	16	16

Investing in Carbon Capture and Storage Development

Carbon capture and storage (CCS) is an integral component of Canada's national plan to reduce greenhouse gas emissions by 20% by 2020 and 60-70% by 2050. CCS has the potential to account for the reduction of significant amounts of carbon dioxide in Canada.

The Government is making significant investments through Budget 2008 to increase the development and deployment of CCS. The Government of Canada will provide \$240 million to the Province of Saskatchewan to partner with industry to implement a full-scale commercial demonstration of carbon capture and storage in the coal-fired electricity sector. The funding will be matched by the province, while the provincial utility, SaskPower, is investing \$758 million into the project.

Also, the **Canada-Alberta ecoENERGY Carbon Capture and Storage Task Force** released a report on January 31, 2008 that identified a number of regulatory, economic and technological issues that require resolution by the Governments of Canada and Alberta in order to accelerate the deployment of carbon capture and storage technologies. Budget 2008 provided \$5 million to the Institute for Sustainable Energy, Environment and Economy at the University of Calgary to work with a broad range of stakeholders on these outstanding issues.

The Government of Alberta also recently launched the Alberta Carbon Capture and Storage Development Council, which will make recommendations for industry to move forward with the technology. The Council includes representatives from different levels of government, including the federal government, and industry. It will develop a clear work plan for implementing CCS in Alberta and report back to the provincial government in Fall 2008.

Finally, given that little is known about the potential of carbon capture and storage on Canada's East Coast, the Government is providing \$5 million to support geological research in Nova Scotia to examine the potential for carbon storage in that province.

It is expected that emission reductions from these initiatives will not be realized until after 2012.

Further Reductions in Emissions from Electricity Generation

Even with tough new federal regulations, and the commitments to close dirty coal-fired power plants and increase the use of renewable and nuclear energy, emissions from electricity generation are projected to be 90 Mt in 2020 – still the single largest source of greenhouse gases in Canada.

The Government of Canada wants to achieve additional emissions reductions from the electricity sector of 25 Mt by 2020, equivalent to closing seven large coal-fired power plants. We are therefore setting up a clean electricity task force to work with the provinces and industry to meet this goal. If required, the Government of Canada is ready to use its regulatory powers to ensure that these reductions are achieved.

Canada's Emissions Levels from 2008 to 2012

In accordance with paragraph 5 (1) (c), the text and the table below set out Canada's projected greenhouse gas emission levels for 2008 to 2012 and how these levels compare with Canada's obligations under Article 3, paragraph 1, of the Kyoto Protocol. In addition to the levels in the table

below, provincial plans and actions are expected to lower Canada's emission levels over the period of 2008 to 2012. However, it is premature to estimate the resulting emissions reductions in the context of this report. The projected emission levels will be verified by the national inventory reports, the first of which will be due on April 15, 2010, with the final report for 2012 due on April 15, 2014. The degree to which Canada has met its emissions reduction obligations under the Kyoto Protocol will be assessed after its final report has been filed in 2014.

Canada's allowable emissions under the Kyoto Protocol for the period 2008 to 2012 are 2,792 Mt.

The Government of Canada used Environment Canada's integrated *Energy, Emissions and Economy Model for Canada* (E3MC) to estimate the reduction for the overall integrated package of measures. The modeled runs incorporated the individual initiatives and aggregated the results to estimate Canada's net emission reductions from a continuing trends baseline to report the remaining emission levels for 2008-2012. This baseline already incorporates many measures and trends currently underway across Canada. Some of the measures included in the baseline are complimentary to federal policies presented in this report. As such, to avoid double-counting, the impacts from these measures are not included in the total emissions reductions. The use of the model responds to the National Round Table's suggested methodological improvement for an "integrative accounting of the emission reduction estimates".

Canada's baseline emissions levels are expected to increase from 746 Mt in 2008 to 801 Mt in 2012. Through the measures presented in this report, emissions levels are expected to be about 2 Mt below the baseline at 744 Mt in 2008 and about 69 Mt below the baseline at 733 Mt in 2012. Over the 2008 to 2012 period, federal actions are expected to reduce emissions, on average, by about 40 Mt per year.

Canada's Emission Levels					
Year	2008	2009	2010	2011	2012
Baseline Pathway Emissions (Mt)	746	765	777	784	801
KPIA Emissions Pathway (Mt)	744	760	715	719	733
Expected Emissions Reductions (Mt) ⁸	2	5	62	65	69

⁸ The estimated emission reductions are based on the targets outlined in the final Regulatory Framework as well as the program measures detailed above. Given that the industrial regulations are a large portion of the overall estimated reductions, actual emission levels will depend on the compliance options chosen by regulated firms.

Conclusion

With this document, the Minister of the Environment has responded to the publication requirements of Section 5 of the *Kyoto Protocol Implementation Act*. The Government's *Turning the Corner Action Plan* is a realistic, balanced and achievable plan. It along with provincial and territorial actions will place Canada on a pathway to achieving absolute reductions of greenhouse gases. *Turning the Corner* employs an integrated approach to reducing air emissions, while supporting continued economic growth.

Provision of Comments

Pursuant to paragraph 5 (3) (a) of the *Kyoto Protocol Implementation Act*, persons are welcome to submit comments about the report to the Minister of the Environment, care of:

Director General, Strategic Policy Branch
Environment Canada
22nd Floor – 10 Wellington St.
Gatineau, Quebec
K1A 0H3

Comments must be provided in writing by June 28, 2008.

Annex 1

Strengthening the Global Framework for Action

Climate change is a global problem that demands large reductions in greenhouse gas emissions around the world. However, Kyoto Protocol countries are responsible for only about a quarter of global emissions. It is also noteworthy that global emissions will be at least 30% higher in 2012 than they were in 1997 when the Protocol was concluded.

It is clear that a global effort that includes the participation of all major emitters is required to make a significant reduction in worldwide greenhouse gas emissions. Only about twenty economies around the world, of which over half are still developing, account for 80% of global emissions. The United States, which has not ratified the Kyoto Protocol, and key developing countries, such as China and India, that do not have targets under the Kyoto Protocol, represent about two-thirds of global emissions.

Within this overall effort, countries must strive to achieve real and verifiable reductions in their greenhouse gas emissions. Canada is focused on using the roadmap developed at the December 2007 UNFCCC Bali Conference to achieve a post-2012 climate change agreement by the end of 2009, with the belief that any such agreement must:

- Balance environmental protection with economic prosperity, and not unduly burden the growth of any single country;
- Be guided by a long-term global goal, which Canada believes should be to cut global emissions in half by 2050;
- Reflect national circumstances;
- Include binding action and commitments by all major emitting economies;
- Promote climate change adaptation in all countries; and,
- Support the development and deployment of new technologies.

Reducing global emissions over the long term will require a significant transformation in the capital stock of energy producing and consuming businesses and households around the world. Countries and industry will likely need to use market-driven approaches that will include the development and deployment of new technologies, as well as emissions trading. These market mechanisms may need to become more mature and robust in order to allow a transparent and comparable carbon price signal to be sent around the world.

The Government of Canada believes that many of the elements of its Plan will help position Canada to take some of these steps and thereby act as a global leader in the development of a post-Kyoto international framework to address global climate change over the long term.

Canada's actions within a global framework on climate change are guided by its work within a number of key international agreements and partnerships.

United Nations Framework Convention on Climate Change

Discussions under the auspices of the UNFCCC are increasingly focused on addressing climate change beyond 2012. At the United Nations Climate Change Conference in Bali, Indonesia in December 2007, Parties adopted the "Bali Action Plan" – a new negotiating process under the Convention to develop a future post-2012 international agreement on climate change. Guided by the need for deep reductions in global emissions, this new process will define mitigation commitments by developed countries and appropriate actions by developing countries that are real and measurable. The building blocks of mitigation, adaptation, technology and finance will frame the negotiations over the next two years.

The launch of the Bali Action Plan represents a major milestone in the international negotiations on climate change. Consensus by all Parties, including major greenhouse gas emitting nations such as the United States, China and India, to develop a new global agreement on climate change that is both comprehensive and effective represents an important step towards an effective global climate change regime

The Bali Conference also agreed to conclude by 2009 negotiations under the Kyoto Protocol for new emission reduction targets for developed countries in a future agreement. A work programme to deliver these targets will proceed in tandem with the negotiations under the new broader process.

It is hoped that the conclusion of the Bali Action Plan and the negotiations under the Kyoto Protocol in 2009 will lead to a comprehensive agreement on climate change that includes real and measurable contributions by all major emitting countries.

G8

The G8 is committed to demonstrating strong leadership and implementing approaches which optimally combine effective climate protection with energy security. In June 2007, G8 leaders met, along with leaders from Brazil, China, India, Mexico and South Africa, in Heiligendamm, Germany to discuss a global approach to combating climate change. Canada played an important role in the meetings, which followed up on the 2005 Gleneagles Dialogue on Climate Change, Clean Energy and Sustainable Development. The Chair's summary of the discussion on climate change noted that:

- A comprehensive post Kyoto-agreement should include all major emitters;
- Major emitting countries should agree on a detailed contribution for a new global framework by the end of 2008 – the first meeting in this process took place in the Fall of 2007, and the process is continuing;
- In setting a global goal for emissions reductions, the decisions made by the European Union, Canada and Japan which include at least a halving of global emissions by 2050 should be considered seriously; and
- Technology, energy efficiency and market mechanisms are key to mastering climate change as well as enhancing energy security.

The Major Economies Process on Climate Change and Energy Security

Canada is a participant in the Major Economies Process on Climate Change and Energy Security, which includes 14 of the world's largest emitters of greenhouse gases and seeks to make progress

toward the creation of an international framework to address climate change in the post-2012 period. A post-2012 agreement on combating climate change must include all major emitting countries in order to be globally successful, which makes this process of significant importance. Meetings have been held in Washington in September 2007 and in Hawaii in January 2008.

The Asia Pacific Partnership on Clean Development and Climate

The Asia-Pacific Partnership on Clean Development and Climate, which includes the U.S., Australia, China, India, Japan and South Korea, brings together countries representing approximately 45% of the world's population, 49% of GDP, and 50% of global emissions of CO₂. Through its focus on the development and deployment of climate-friendly technologies, the Partnership is a significant opportunity for Canada to work in cooperation with key developed and developing country emitters as well as the private sector, to support the development and uptake of the technological solutions that will be crucial to any future approach to addressing climate change. The Partnership offers a forum for Canada to pursue its objective of lower greenhouse gas emissions through technological solutions.

North American Cooperation

Canada, Mexico and the United States represent almost one quarter of global greenhouse gas emissions. Continental cooperation could play an important role in the development of a post-Kyoto international framework. At their Summit meeting in April 2008 in New Orleans, the leaders of all three countries committed to redoubling their efforts to address climate change and confirmed their support for the Bali Action Plan.

Canada is exploring opportunities with U.S. partners for linking Canada's emission trading system with regulatory-based emissions trading systems at the regional and state level and with any that may be established at the federal level. Canada will also explore cooperation on emissions trading with Mexico.

Canada is sharing its considerable experience and expertise in the oil and gas industry through the U.S.-led Methane to Markets Partnership and Carbon Sequestration Leadership Forum, and International Partnership for a Hydrogen Economy.

Asia-Pacific Economic Cooperation

The economies of APEC account for 60 % of global energy demand and include the world's four largest energy consumers as well as many of the major emitters. A number of APEC economies are engaged in a range of joint initiatives in areas such as clean coal technology, renewable energy and energy efficiency aimed at reducing greenhouse emissions.

Annex 2

Methodology for Estimating the Expected Greenhouse Gas Emissions Reductions

Introduction

This Annex describes the approaches taken to calculate estimated reductions from the measures detailed in the report. Two types of estimation procedures were used. Reduction estimates have been calculated on a case-by-case basis for the individual measures in the document as per paragraphs 5 (1) b (ii) of the Act. In addition, Environment Canada's integrated Energy, Emissions and Economy Model for Canada (E3MC) was used to estimate the emissions reduction for the overall integrated package of measures and the modeled results were used to report on Canada's emission reductions and total remaining emission levels for 2008-2012, thereby satisfying paragraph section 5(1)(c) of the Act.

The advice of the National Round Table on the Environment and the Economy is a key factor in the Governments' methods for estimating reductions. The *Response of the National Round Table on the Environment and the Economy to its Obligations Under the Kyoto Protocol Implementation Act* (September 2007) suggested certain methodological improvements for the development and presentation of reasonably expected emission reductions. These included the following:

- Transparency and clarity regarding assumptions and methodologies;
- Consistency in accounting for emission reductions over the relevant time period; and,
- Integrative accounting of results, where all programs are assessed in an integrated manner and the overall contribution accounts for positive and negative interactions between measures and regulations.

Estimates for Reductions from Individual Measures

This section describes the methodology used to generate emissions reductions from individual measures as well the resulting emissions levels for Canada in 2008-2012 that are required under paragraphs 5 (1) b (ii) of the Act.

Expected reductions from individual measures were estimated by the responsible department, with related parameters incorporated into E3MC. The methodologies for each individual measure are described below.

The Regulatory Framework for Industrial Greenhouse Gas Emissions

Industrial Greenhouse Gas Regulations

The March 2008 Regulatory Framework set an initial required reduction of 18% from 2006 emission intensity levels in 2010 for existing facilities. Every year thereafter, a 2% continuous improvement in emission intensity will be required. By 2015, therefore, an emission-intensity reduction of 26% from

2006 levels will be required, with a further reduction to 33% by 2020. New facilities, which are defined as those whose first year of operation is 2004 or later, will be granted a three-year commissioning period before they will face an emission-intensity reduction target. After the third year, new facilities will be required to improve their emission intensity each year by 2%. A cleaner fuel standard will be applied, thereby setting the target as if they were using the designated fuel. New coal-fired electricity generation and oil sands facilities coming into operations in 2012 or later, will be required to achieve an emission intensity target which reflects the use of carbon capture and storage.

Environment Canada's E3MC model was used to estimate the emissions intensity reductions. Actual and forecasted emissions for 2006 are available in the E3MC reference case for most of the covered industrial sectors. GHG emissions are disaggregated in three broad categories: combustion-related, process and non-energy. For each of those categories, the share of what is fixed process emissions has been estimated. Those shares have been applied to the reference case GHG emissions in 2006 to produce a net figure for covered GHG emissions by covered sectors. The modelling of the targeted reductions under the Regulatory Framework for Industrial Greenhouse Gas Emissions was approached as follows:

- **Establishing the baseline** – The model was disaggregated to explicitly model each regulated sector. Economic growth and an emissions path were established for each regulated sector. In addition, the emissions pathway was adjusted to account for emissions which were deemed to be excluded under the framework (e.g., industrial fixed process emission and unintentional fugitives).
- **Targeted Reductions** – In order to calculate emissions intensity (emissions per unit of production), different measures of production were used. For the electricity sector, total electricity generated by fossil fuel was used. In the oil and gas sector, it was total production in the gas sector and oil sub-sectors. Gross Output was used for all the other covered sectors. Once the targeted intensities were defined, they were translated into targeted emission levels for each year. The targets were applied to each sector to estimate the required reductions to achieve the regulated reductions

Reductions under the Regulatory Framework presented in this report represent the aggregation of reductions credited under all compliance options available to industry, in accordance with the targets contained in the final Regulatory Framework released in 2008. Actual in-year reductions will vary from these amounts, depending on the specific compliance options chosen by individual firms. E3MC modeling indicates that choice of compliance option is in turn influenced by differences in marginal costs that they present to regulated industries.

Best Practices for the Capture of Unintentional Fugitive Emissions and HFCs

The Regulatory Framework mandates the application of best practices with respect to the control of unintentional fugitive emissions and HFCs.

- **Fugitive emission reductions:** In this analysis, it was assumed that emissions from unintentional fugitives, accounting for about 46 per cent of total fugitives emissions, would decrease by 50 per cent by 2020. This represents an average reduction of fugitives of about 3.5 per cent per year starting in year 2010.

HFC emission reductions: In the model, it was assumed that HFC emissions would decrease by 50 per cent between 2010 and 2020.

Regulating Energy Efficiency — Strengthening Energy Efficiency Standards

For each product proposed for regulation, NRCan calculates an initial estimate of the energy savings associated with introducing a minimum performance standard. The number is adjusted for the impact of labeling. The initial estimate is an aggregate of the estimated annual energy savings between sales of non-compliant and compliant products. These savings are based on estimates of the current level of efficiency of the least-efficient, most popular product, of a proposed minimum performance level, and of sales / shipments that would not comply with the prospective standard. Initial estimates are refined through the regulatory process and details are published in a Regulatory Impact Analysis Statement. Energy savings (by fuel) were converted to greenhouse gas reductions using standardized conversion factors.

Regulating Renewable Fuels Content

Greenhouse gas emission reductions were estimated based on the expected incremental volume of renewable fuel resulting under the federal renewable fuels regulation. The incremental renewable fuel volume is estimated based on 5% of the Canadian gasoline pool and 2% of diesel and heating oil, less provincial regulated requirements in place or announced. Per litre life cycle greenhouse gas emission reduction factors developed by Natural Resources Canada for ethanol used to displace gasoline and for biodiesel used to displace diesel were then combined with expected incremental volumes to estimate the greenhouse gas emission reductions. The emission reduction factors are informed by a large pool of information, including extensive analysis performed using Natural Resources Canada's GHGenius model, and were selected to represent representative Canadian conditions.

ecoENERGY for Renewable Power

Greenhouse gas emission reductions were estimated based on the expected total capacity, their associated expected clean energy production, and an emission factor of displaced fuel. The expected total capacity deployed was estimated based on prior program experience, earlier program development consultations, industry information, and the level of program funding. The expected clean energy production estimates were developed based on prior program experience, technology specific assumptions, and industry information. The greenhouse gas emission factor was developed based on the provincially-weighted average of marginal fuel sources across the country.

ecoENERGY for Renewable Heat

Greenhouse gas emission reductions were estimated based on the number of expected projects, associated energy savings, and an emission factor of displaced fuel. The number of expected projects was estimated based on prior program experience and the level of program funding. The energy savings estimates were developed based on prior program experience, technology specific assumptions, and information contained in the 2005 Energy Use Data Handbook. The greenhouse gas emission factors were fuel specific and for electricity it was based on the provincially weighted average of marginal fuel sources across the country.

ecoENERGY for Buildings and Houses

This program contains a number of elements whose impacts were calculated individually. Technical and past program files provided average savings growth and participation for each element, other than code improvement. There the impact was based on an assessment of the improvement to be gained from an upgraded and provincially adopted (in 2010/2011) Model National Energy Code for Buildings and a forecast of new commercial floor space. Energy savings (by fuel) were converted to greenhouse gas reductions using standardized conversion factors.

ecoENERGY Retrofit Initiative

Technical and past program files provided average savings and participation for each sub-component of the initiative: existing houses, small and medium buildings, and industrial facilities. Energy savings (by fuel) were converted to greenhouse gas reductions using standardized conversion factors.

ecoENERGY for Industry

Technical studies and past program files provided average savings and participation for both elements of the program. Energy savings (by fuel) were converted to greenhouse gas reductions using standardized conversion factors.

ecoAUTO Rebate Program and Green Levy

To calculate anticipated reductions in GHG emissions from the ecoAUTO rebate program and the Green Levy, Transport Canada used the North American Feebate Analysis Model (NAFAM). Like Environment Canada's E3MC model, the NAFAM model approximates consumers and manufacturers decisions Qualitative Choice Theory. These decisions are based on the price of buying and operating a vehicle with the perceived trade-off between energy savings through improved efficiency and capital and operating costs. In order to determine the impact of the policies on greenhouse gas (GHG) emissions, NAFAM incorporates a simplified version of Natural Resources Canada's CHAMPAGNE model, a light-duty vehicle stock-accounting framework.

The model was calibrated to data reflecting the characteristics of 2003 model-year vehicles available for sale in the North American market (Canada and United States). These vehicles are then "evolved" through time, using assumptions about consumer preferences, technology cost, fuel consumption improvements, and industry production plans reflecting decision-making in a North American market. Transport Canada has used reasonable assumptions when choosing values for variables such as the elasticity of demand (market-level (-1.0), class-level (-2.5), within-class (-5.0)), technology cost and vehicle fuel consumption (EEA 2005), and manufacturer production plans of vehicles (EEA 2005). In addition, to take account of the rebound effect, Transport Canada has assumed a value of -0.23 for the elasticity of vehicle distance traveled with regards to fuel cost per kilometre.

In NAFAM, the impact of the policy is estimated against a "base case" scenario where the model is run without any policy intervention. With everything else being held constant, all the changes in the values observed are associated with the policy. The model will compare the characteristics of a vehicle, its use, and actual sales number, with or without the policy. This in essence is how the analysis takes into account the free-rider issue.

The estimate of annual GHG savings due to the policies are calculated by using the difference between the annual GHG emissions estimate calculated for the base case and the annual estimate calculated for the policy scenario. The resulting savings are incremental, annual emission reductions attributed to, respectively, the ecoAUTO rebate program and the Green Levy.

ecoENERGY for Personal Vehicles Initiative

This program contains a number of elements whose impacts were calculated individually. Accepted industry models provided estimates of growth in vehicle stock, drivers and fuel use; while technical studies and past program files provided estimates of participation, rates of adoption and retention of fuel efficient practices, and the average impact of such practices. These were combined in calculations that provided fuel savings, which were then converted to greenhouse gas reductions using a standardized conversion factor for gasoline.

ecoMOBILITY Initiative

Estimates for this program assumed a 3% reduction to total vehicle kilometres traveled (VKT) in urban areas by 2010 would be achieved by program activities. This assumption came from the "high TDM" option used in a study commissioned by Transport Canada ("The Impact of Transit Improvements on greenhouse gas Emissions: A National Perspective", Transport Canada, March 2005).

The 3% reduction was applied to historical VKT data available from NRCan Energy Efficiency Trends in Canada and Canada Energy Outlook reports to obtain the resulting reductions in fuel use, which were then converted to greenhouse gas reductions using the conversion factors published by EC (National Inventory Report, Greenhouse Gas Sources and sinks in Canada).

It is important to note that ecoMOBILITY builds on major urban transit infrastructure investments, including those that are anticipated under the Government of Canada's infrastructure funding. Emission reductions estimates are reliant on such investments taking place.

National Vehicle Scrappage Program

The estimates for this program are based on a series of assumptions described below.

A total of 200,000 vehicles (model year 1995 and older) will be retired over the life of the program (March 31, 2011). EC also considers the transportation behaviour of program participants for the year following the scrappage of their vehicle; assume that 50% of program participants will choose to replace their scrapped cars by a newer one (model year 2004 and later). The remaining participants will use public transit. This 50-50 split is in-line with results for scrappage programs currently supported by Environment Canada.

Annual usage of 1995 and older vehicles is based on StatCan's 2006 Canadian Vehicle Survey results (11,800 km/year). EC is assuming that the replacement vehicle will be driven 28% more than the old one. This estimate is based on results of the U.S. National Household Transportation Survey. No Canadian equivalent data has been found, but U.S. and Canadian data show the same trend of decreasing annual vehicle usage with increasing vehicle age. Transit emissions are based on usage for commuting purposes and rely on CUTA statistics.

ecoTECHNOLOGY for Vehicles Program

Greenhouse gas savings for the eTVP are based on estimates calculated for the previous Advanced Technology Vehicle Program, which followed a similar program model on a smaller scale.

It was assumed that 20% of new vehicles sales with less than 6 l/100 kms fuel efficiency would be supported by the public outreach and education activities of eTVP overtime. Sales forecasts were taken from Transport Canada's NAFAM analytical framework.

The average fuel saving of new vehicles was assumed to be about 2 l/100 kms in any particular year. And the average distance travelled by new vehicles (23,500 kms per year) came from TC's Canadian Vehicle Survey.

ecoENERGY for Fleets

This program contains a number of elements whose impacts were calculated individually. Accepted industry models provided estimates of growth in annual vehicle travel. Technical studies and past program files provided estimates of participation, rates of adoption of fuel efficient practices, and the average impact of such practices. The generated savings, as measured in kilometres or fuel saved, were then converted to greenhouse gas reductions using standardized conversion factors (by fuel type).

ecoFREIGHT

The ecoFreight programs impact was based on analysis of past programs, and representative technologies identified in all modes through those programs. Assumptions about the average fuel savings from projects funded under these previous programs were then applied to the new ecoFREIGHT program.

For the purpose of the ecoFreight program we then pro-rated the impact to individual initiatives based on the funding allocated under ecoFreight.

Note: The Marine Shore Demonstration Program impact was estimated separately. The impact of the ecoFreight Partnerships program and the Harmonization Initiative were not estimated separately, but assumed to be integral to the greenhouse gas impact of accelerated technology uptake reflected in the total greenhouse gas impact estimate. (i.e. To calculate them separately would be to introduce a double counting of greenhouse gas reductions.)

The Marine Shore Power Program

It was assumed that each project funded under the program would achieve the average savings calculated from the projects considered in Transport Canada's *Feasibility Study to Determine Suitable Locations for Marine Shore Power Pilot Projects in Canada* (Final Report, July 2005). It was assumed that 4 projects would be funded under the program and that 2 replicated projects would subsequently be implemented over time.

Promoting Sustainable Urban Transit

Upon review of the methodology used for the 2007 Plan, an updated methodology was used to calculate the estimated emission reductions for the 2008 Plan.

The calculations for the 2008 Plan used information on public transit trips (ridership) and greenhouse gas emissions factors from the Climate Change Transportation Table. A constant 2.5% annual growth (avg. of the last 4 years) in ridership was used to project baseline levels of ridership over the 2008-2012 period. Based on a calculation, that the tax credit of 15.0% on the purchase cost of eligible transit products would have the same impact as an effective overall fare reduction of 9.0% on all transit expenditures, and using a short-term own-price elasticity for the overall market of 2.5%, which is based on a study by Litman for the Victoria Transport Policy Institute, new (incremental) trips resulting from the tax credit were calculated. These new trips were adjusted to estimate reduced vehicle trips based on information on vehicle occupancy from Transport Canada, and appropriate emissions factors were applied to these figures to produce the emission reduction estimates for each year.

It is important to note that there are many factors at play which makes it extremely difficult to assign greenhouse gas emissions reductions to this measure with any certitude. Vehicle operating cost increases (fuel price, parking costs, etc.), and transit supply or service improvements are just two factors that can influence ridership. Moreover, improvements to vehicle fuel economy and the increased penetration of lower-emitting fuels, would work to lower the overall emissions reduction potential. Therefore we believe that the estimated reductions are likely representative of the upper bound of potential reductions for this measure.

Canada's Greenhouse Gas Emissions Levels for 2008-2012

The Government of Canada is applying Environment Canada's integrated *Energy, Emissions and Economy Model for Canada (E3MC)* to estimate the reduction for the overall integrated package of measures. The modeled runs incorporated individual parameters for each of the initiatives reported here, as provided by lead departments, and aggregated the results to report on Canada's net emission reductions and total remaining emission levels for 2008-2012. The use of the model responds to the National Round Table's suggested methodological improvement for an "integrative accounting of the emission reduction estimates".

The E3MC model incorporates an updated energy, emissions and economy baseline that includes the latest greenhouse gas emissions inventory published by Environment Canada. This baseline already incorporates many measures and trends currently underway across Canada. The date of January 1, 2006 has been applied as the cut-off point for defining existing measures that are to be included in the baseline. Some of these measures included in the baseline are complimentary to federal policies presented in this report. As such, to avoid double-counting, the impacts from these measures are not included in the total emissions reductions. Some key assumptions in the baseline that affect federal KPIA policies include:

- The closure of all coal-fired electricity generation plants in Ontario by 2014;
- The adoption of the Renewable Portfolio Standard by all provinces; and
- The implementation of provincial mandates for mandatory content of ethanol in gasoline.

To capture the effects of the Government's climate change programs, the assumptions used for the individual measures were built into the closely replicated E3MC model. In the model, consumers of energy respond to the program parameters by making decisions regarding investments using Qualitative Choice Theory.⁹ These decisions are based on the price of fuel combined with the perceived trade-off between energy savings through improved efficiency and capital and operating costs. For example, a program such as the ecoENERGY Retrofit Initiative provides financial support to reduce the cost of implementing an energy efficiency project, encouraging investment by improving the trade-off between efficiency and investment costs.

The 2008-2012 emission levels for Canada were generated by combining the individual emissions reductions measures in E3MC. This ensured that measures were assessed in an integrated manner, thereby accounting for positive and negative interactions between measures and regulations.

Environment Canada's E3MC Model

Environment Canada's E3MC has two components: Energy 2020, which incorporates Canada's energy supply and demand structure, and TIM, Informetrica's macroeconomic model of the Canadian economy.

Energy 2020 is an integrated multi-region, multi-sector North American model that simulates the supply, price and demand for all fuels. The model can determine energy output and prices for each sector, both in regulated and unregulated markets. It simulates how factors like energy prices and government policies affect the choices that consumers and businesses make in the purchase and use of energy. The model's outputs, which include changes in energy use, energy prices, greenhouse gas emissions, investment costs and possible cost savings from policies, are used to identify the direct effects stemming from greenhouse gas reduction measures. The resulting savings and investments from Energy 2020 are then used as inputs into TIM.

TIM is used to examine consumption, investment, production, and trade decisions in the whole economy. It captures not only the interaction among industries, but also the implications for changes in producer prices, relative final prices and income. It also factors in government fiscal balances, monetary flows, interest and exchange rates.

More specifically, TIM incorporates 133 industries at a provincial and territorial level. It also has an international component to account for exports and imports, covering approximately 100 commodities. The model projects the direct impacts on the economy's final demand, output, employment, price formation and sectoral income that result from various policy choices. These, in turn, permit an estimation of the effect of climate change policy and related impacts on the national economy.

Treatment of Interaction Effects

The analytical approach permitted by E3MC addresses several key modelling challenges, namely additionality, free ridership, rebound effects, and policy-interaction effects.

The additionality issue refers to the question of what would have happened without the initiative in question. Problems of additionality arise when the stated emissions reductions do not reflect the difference in emissions between equivalent scenarios with and without the initiative in question. This

⁹ Qualitative Choice Theory is based on the work of the Nobel Laureate, Daniel McFadden. Using Dr. McFadden's theory, several other leading economists such as Kenneth Train have applied this theory to estimating demand in key energy using sectors of the economy such as transportation and the built environment.

will be the case if stated emissions reductions from an initiative have already been included in the reference case – emissions reductions will effectively be double-counted in the absence of appropriate adjustments. In the E3MC model, additionality is controlled for by the fact that model structure is based on incremental or marginal decision making. The E3MC model assumes a specific energy efficiency or emission intensity profile at the sector and end-use point (e.g., space heating, lighting, auxiliary power, etc). Under the E3MC modelling philosophy, if the initiative in question was to increase the efficiency of a furnace, only the efficiency of a new furnace would be changed. The efficiency of older furnaces would not change unless those furnaces are retired and replaced with higher efficiency ones. As such, any change in the model is incremental to what is reflected in the business-as-usual assumptions.

A related problem that of free ridership, arises when stated reductions include the results of behaviour that would happen regardless of the policy. This can occur when subsidies are paid to all purchasers of an item (e.g., a high efficiency furnace), regardless of whether they purchased the item because of the subsidy. Those who would have purchased the product regardless are termed free riders. In our model, the behaviour of free-riders has already been accounted for in the reference case. Their emissions are not counted, therefore, toward the impact of the policy. Instead, it is only the incremental take-up of the emissions-reducing technology that is counted.

The rebound effect describes the increased use of a more efficient product resulting from the implied decrease in the price of its use. For example, a more efficient car is cheaper to drive and so people may drive more. Emissions reductions will generally be overestimated by between 5% and 20%, if estimates do not account for increased consumption due to the rebound effect. Within the model, we have mechanisms for fuel choice, process efficiency, device efficiency, short-term budget constraints and cogeneration, which all react to changes in energy and emissions costs in different time frames.¹⁰ All these structures work to simulate the rebound effect – in the example above, the impact of extra kilometres that may be driven as a result of improved fuel efficiency are automatically netted out of the associated emissions reduction estimates. Finally, emissions-reduction policies such as the ones defined in the Government's plan interact with each other, with a resulting impact on their overall effectiveness. A policy package containing more than one measure or policy would ideally take into account this impact to understand the true contribution the policy package is making (in this case to emission reductions). This impact is described through what are known as policy interaction effects.

E3MC is a comprehensive and integrated model focusing on the interactions between sectors and policies. In the demand sectors, the fuel choice, process efficiency, device efficiency, and level of self-generation are all integrally combined in a consistent manner. The model has detailed equations to ensure that all the interactions between these structures are simulated with no loss of energy or efficiency. For example, the electric generation sector responds to the demand for electricity from the energy demand sectors, so any policy to reduce electricity demand in the consumer sectors will impact the electric generation sector. The model accounts for the emission in the electric generation sector as well as the consumer demand sectors. As the electric sector reduces its emissions intensity, policies designed to reduce electric demand in the consumer sectors will cause less of an emissions reduction. The natural gas and oil supply sectors similarly respond to the demands from the consumer sectors, including the demands for refined petroleum products for transportation. As well, the export by supply sectors of their products is also simulated.

¹⁰ A shift in energy prices will cause cogeneration to shift in the short to medium term, device efficiency to adjust over the short to mid-term, process efficiency to adjust in the mid term, and fuel choice to react in the mid- to long-term. The actual adjustment times depend on the particular sector.

Taken as a whole, the E3MC model provides a detailed representation of technologies that produce goods and services throughout the economy and can realistically simulate capital stock turnover and choices among technologies. It also includes a representation of equilibrium feedbacks, such that supply and demand for goods and services adjust to reflect policy. Given its comprehensiveness, E3MC covers all the greenhouse gas emissions sources, including those unrelated to energy use.

Simulation of capital stock turnover

As a technology vintage model, E3MC tracks the evolution of capital stocks over time through retirements, retrofits, and new purchases, in which consumers and businesses make sequential acquisitions with limited foresight about the future. This is particularly important for understanding the implications of alternative time paths for emissions reductions. The model calculates energy costs (and emissions) for each energy service in the economy, such as heated commercial floor space or person kilometre traveled. In each time period, capital stocks are retired according to an age-dependent function (although the retrofitting of un-retired stocks is possible, if warranted by changing economic conditions). Demand for new stocks grows or declines depending on the initial exogenous forecast of economic output (i.e., a forecast that is external to the model and not explained by it) and the subsequent interplay of energy supply-demand with the macroeconomic module. A model simulation iterates between energy supply-demand and the macroeconomic module until there is a convergence. The global convergence criterion is set at 0.1 per cent between iterations. This convergence procedure is repeated for each year over the simulation period.¹¹ E3MC simulates the competition of technologies at each energy service node in the economy based on a comparison of their cost and some technology-specific controls, such as a maximum market share limit in cases where a technology is constrained by physical, technical or regulatory means from capturing all of a market. The technology choice simulation reflects the financial costs as well as the consumer and business preferences, revealed by real-world technology acquisition behaviour.

Model Challenges and Limitations

While E3MC is a very sophisticated analytical tool, no model can fully capture the complicated interactions associated with given policy measures between and within markets or between firms and consumers. Unlike computable general equilibrium models, however, the E3MC model does not fully equilibrate government budgets and the markets for employment and investment. That is, the modelling results reflect rigidities such as unemployment and government surpluses/deficits. Furthermore, the model, as used by Environment Canada, does not generate changes in nominal interest rates and exchange rates, as would occur under a monetary policy response to a major economic event.

¹¹ The energy technology simulation component of the E3MC model (i.e., Energy 2020) does not have an explicit test for convergence because of the algorithm used for in the model. The macroeconomic component of the E3MC model (i.e. The Informetrica Model or TIM) is used to test for convergence between the two models because logically if one model continues to send the identical information to the other model then necessarily the other model should find the exact same solution as before. As the initial testing showed that after about 3 iterations most of the variables in TIM were very close to convergence, the maximum iteration for convergence is set to 5.

